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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/692,611	10/24/2003	Mohan Chandra	884.B40US1	8818
21186	7590	03/02/2006	EXAMINER	
SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH 1600 TCF TOWER 121 SOUTH EIGHT STREET MINNEAPOLIS, MN 55402			RAO, G NAGESH	
			ART UNIT	PAPER NUMBER
			1722	

DATE MAILED: 03/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	Application No. 10/692,611	Applicant(s) CHANDRA ET AL.	
	Examiner G. Nagesh Rao	Art Unit 1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-27 is/are pending in the application.  
4a) Of the above claim(s) 14-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

## DETAILED ACTION

### *Election/Restrictions*

1) Restriction to one of the following inventions is required under 35 U.S.C.

121:

- I. Claims 1-13, drawn to a crucible, classified in class 117, subclass 220.
- II. Claim 14-27, drawn to a process for forming a silicon ingot and wafer, classified in class 117, subclass 11.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as apparatus and product made. The inventions in this relationship are distinct if either or both of the following can be shown: (1) that the apparatus as claimed is not an obvious apparatus for making the product and the apparatus can be used for making a materially different product or (2) that the product as claimed can be made by another and materially different apparatus (MPEP § 806.05(g)). In this case the product made does not necessarily require the apparatus i.e. the crucible to form a silicon ingot, furthermore the crucible itself is not materially limited to forming just silicon ingots and could be used to make glass or GaAs ingots, it is not materially limited to forming silicon only.

Because these inventions are independent or distinct for the reasons given above and have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with David Peterson on 2/15/06 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-13. Affirmation of this election must be made by applicant in replying to this Office action. Claims 14-27 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2) Claims 1-2 and 4-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Pinkhasov (US Patent No. 4,565,711).

Pinkhasov teaches in particular its claim language (Claims 8-11) besides its specification a coating for a quartz crucible (by the way is a hexagonal crystal structure made of trigonal crystallized silica ( $\text{SiO}_2$ ) (10) which as shown in Figure 1 has a base container capable of containing a liquid silicon material and a coating process imposed by vapor generator (13) for coating among many different types of coatings either silicon or boron nitride onto the crucible container (See Col 1 Lines 62-68, Col 3 Lines 26-51, and Col 5 Lines 21-55). This reference also teaches that there is an equivalency between boron and silicon nitride coatings in particular a quartz crucible which materially would inherently have a CTE of 0.59 which is less than the CTE value of 3 for silicon. Finally the crucible as taught and depicted by Pinkhasov 711 shows the container being integrally formed and including multiple components, i.e. it is a full container with a bottom and two side walls which would read on integrally formed and having multiple components as it is situated on turntable (11) as it is interacted with components 13 (vapor generator) and the counterelectrode (21).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
- 3) Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pinkhasov (US Patent No. 4,565,711) in view of Yamagishi (US Patent No. 5,788,718).

Pinkhasov 711 fails to explicitly teach or include the base container to include graphite.

In an apparatus pertaining to a method for growing for example a single silicon crystal, Yamagishi 718 depicts in Figure 1 a quartz crucible (5) being made of a material that has a CTE lower than silicon but the base container also is

comprised of a second tier container below the quartz crucible container (5) with a graphite crucible container (6), and considering the Yamagishi 718 reference teaches coatings of the instruments used in silicon crystal growth including the use of silicon nitride, it is safe to presume this reference is very analogous to the Pinkhasov 711 reference.

It would therefore at the time of the invention be obvious to one with ordinary skill in the art to modify the Pinkhasov 711 reference with that of Yamagishi 718 to include a graphite bottom to let's say a quartz bottom to aid in temperature distribution when dealing with temperature fluctuations for melting and cooling of crystalline material in the crucible and aiding/preventing crucible breakage, since graphite is a good thermal conducting material.

4) Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pinkhasov (US Patent No. 4,565,711) in view of (JP 60141696A).

Pinkhasov 711 from the aforementioned taught a crucible with a boron nitride coating however it failed to teach the additional coating layer of a silicon nitride. Even though Pinkhasov 711 taught that both silicon and boron nitrides were viewed as coating equivalents in the art.

However Pinkhasov 711 fails to teach the additional coating of a silicon nitride ontop of per se the boron nitride coated crucible or vice versa.

JP 696 pertains to a single crystal growth container by forming a silicon nitride then boron nitride layer on a quartz container. In other words JP 696 teaches a quartz container for example a crucible that has a silicon nitride layer coating and then ontop a boron nitride layer unlike how applicant has claimed the crucible with a boron nitride followed by the silicon nitride layer. However Pinkhasov 711 teaches that both silicon and boron nitride layers are seen as coating equivalents. As well JP 696 teaches the crucible but the coatings in reverse order, but exemplifies that the additional coating enables good adhesion with a middle layer coating between the external coating layer and the crucible, as well aid in preventing any deterioration or contamination of the liquid crystal forming from contact with the crucible.

Therefore at the time of the invention it would be obvious to one with ordinary skill in the art to understand that boron and silicon nitride coatings are seen as equivalents and want to put an additional coating layer to maintain better adhesion between the crucible and external coating layer as well, further ensure any possible contamination from occurring between the crucible and the liquid crystal melt.



5) Claims 8-10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711).

Wilson 717 pertains to a crystallization at high pressure apparatus where clearly shown in Figure 1 there is taught a furnace (12) surrounding a crucible (16) that includes cooling system (26) designed to extract heat from the crucible using cooling tubes (28) and which would read on a directional solidification cooling system and further includes a control gas system (30 and 32) (Also See Col 2 Lines 47-72 and Col 3 Lines 1-75).

Wilson 717 however fails to teach the specified teachings of the particulars of the crucible designed and enclosed in the Wilson 717 apparatus.

However Pinkhasov 711 teaches a crucible that read on the particulars defined in claim 8 and would be ideally suitable to change the crucible of Wilson 717 and enclose the crucible designed by Pinkhasov 711.

It would be obvious at the time of the invention to one with ordinary skill in the art to swap out the crucible taught by Wilson 717 with that of Pinkhasov 711 to further optimize the processing and apparatus conditions pertaining to the

particulars of growing a crystalline material like that of single silicon crystal ingots.

6) Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711) in further view of Yamagishi (US Patent No. 5,788,718).

The hypothetical device of Wilson 717 and Pinkhasov 711 teaches an apparatus system that reads on applicant's claimed invention (See aforementioned rejection for details). However they both fail to teach the use of a graphite base container along with the crucible.

Yamagishi 718 as explained in the set of rejections pertaining to claim 3, teaches the use of a crucible with a graphite as a material as part of the base container. The reason being that it is a good thermal conductor.

Therefore it would be obvious at the time of the invention to one with ordinary skill in the art to modify the teachings of Wilson 717 and Pinkhasov 711 with that of Yamagishi 718 to include a base container comprised of graphite as well in order to take advantage of the material's good thermal conduction as well further optimize the apparatus's processing conditions depending on the material processed.

7) Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711) in further view of (JP 60141696A).

The hypothetical device of Wilson 717 and Pinkhasov 711 teaches an apparatus system that reads on applicant's claimed invention (See aforementioned rejection for details). However they both fail to teach the initial layer of boron nitride on the crucible followed by the silicon nitride ontop of the boron nitride.

JP 696 pertains to a single crystal growth container by forming a silicon nitride then boron nitride layer on a quartz container. In other words JP 696 teaches a quartz container for example a crucible that has a silicon nitride layer coating and then ontop a boron nitride layer unlike how applicant has claimed the crucible with a boron nitride followed by the silicon nitride layer. As well Pinkhasov 711 teaches that both silicon and boron nitride layers are seen as coating equivalents. As well JP 696 teaches the crucible but the coatings in reverse order, but exemplifies that the additional coating enables good adhesion with a middle layer coating between the external coating layer and the crucible, as well aid in preventing any deterioration or contamination of the liquid crystal forming from contact with the crucible.


Therefore at the time of the invention it would be obvious to one with ordinary skill in the art to understand that boron and silicon nitride coatings are seen as equivalents and one would want to put an additional coating layer to maintain better adhesion between the crucible and external coating layer as well, further ensure any possible contamination from occurring between the crucible and the liquid crystal melt. Thus the teachings of JP 696 would further optimize the apparatus and conditions that may be put forth on the hypothetical device taught by Wilson 717 and Pinkhasov 711.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to G. Nagesh Rao whose telephone number is (571) 272-2946. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571) 272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GNR



ROBERT KUNEMUND  
PRIMARY EXAMINER